DOCUMENT RESUME

ED 154 805 IR 005 908

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TITLE Information Systems: Fact or Fiction.
PUB DATE Oct 77
NOTE 13p.; Paper presented at the Xerox Computer Users' Group (Palm Springs, California, October 1977)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS Community Colleges; *Computer Oriented Programs; *Electronic Data Processing; *Higher Education; Information Systems; *Management Information Systems; On Line Systems; *Programing; Time Sharing

ABSTRACT

Rising costs of programming and program maintenance have caused discussion concerning the need for generalized information systems. These would provide data base functions plus complete report writing and file maintenance capabilities. All administrative applications, including online registration, student records, and financial applications are running on such a system at Citrus College with no traditional application programs. Using the system, typical reports are implemented in minutes, and often by users. Application maintenance has been cut to less than five percent of the total programming time, allowing 95 percent for user requests. New systems are implemented in a fraction of the time it takes with traditional programming. File maintenance, reporting, and miscellaneous functions as well as seven processes defined for CP-V are enumerated. (Author/JPF)

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INFORMATION SYSTEMS:

FACT OR FICTION

by

William Bearley

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INFORMATION SYSTEMS
FACT OR FICTION

by WILLIAM BEARLEY

INTRODUCTION

In today's world of change data processing installations need a new generation of powerful application programming languages. These languages would eliminate the traditional line by line coding and would provide both data base functions as well as high level data manipulation functions such as SORT, REPORT, and UPDATE. This paper will describe these systems; the rationale for using this type of system; the facilities of a typical system; the use of the system; the structure of a system running under CP-V; and some typical applications.

Looking at the evolution of programming languages and data base systems three significant stages can be identified. First, the traditional method shown in Figure 1 where each program defined the data, manipulated the data and did all I/O operations. If multiple programs accessed the same data there were duplicate definitions in each program. If the data structure

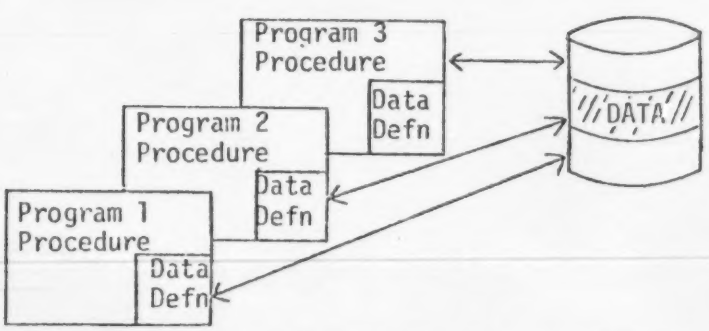

Figure 1 Traditional Programming Method

was modified each program had to be changed and recompiled. Each program described all operations to carry out its task in detail leading to duplication of similar functions. Although report logic is basically the same for all reports with only the detail being slightly different, each report was a duplication of effort. The same holds true for updates, file creations, data selections, sorts and other similar functions.

The data base method such as EDMS is the second stage of development. As shown in Figure 2 the data description is removed from the program and I/O done through a centralized data base system. If data structure is altered, the data base description is updated and the applications program continues to operate without change. This does not, however, eliminate the duplicate effort needed to code, line by line, each report, update, and so forth.

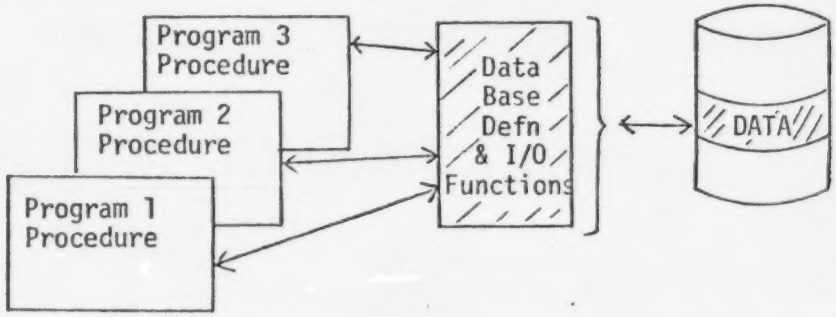

Figure 2 Data Base Method

The third stage which includes data base functions along with general purpose processing functions will be called the information system method in this paper. Figure 3 shows the implementation of this type of system. Powerful processing functions such as REPORTING, SORTING, UPDATING, SELECTING, SEARCHING, COMPUTING and so forth are provided and are available to the user through control statements and parameters in both a batch and time-sharing environment. The user no longer needs to deal with the logic of reports.

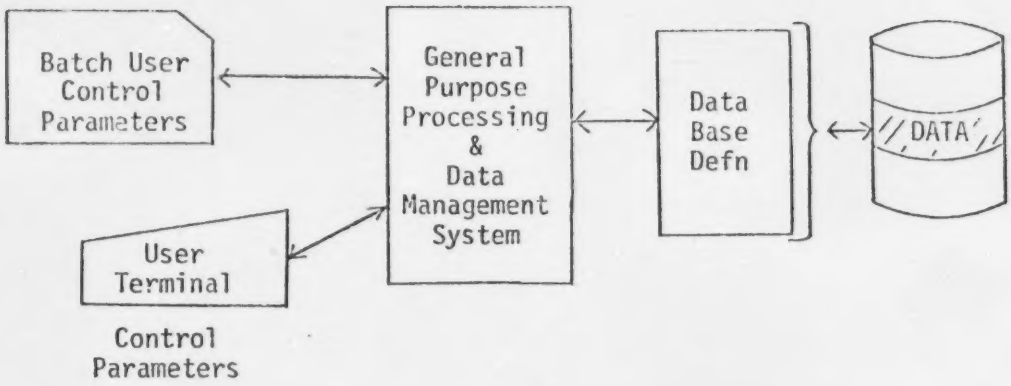

Figure 3 Information System Method

They merely define the layout of the data to the system. Any changes to the data base will be made dynamically and will be available to the users next time they enter parameters. Collections of control parameters can be stored and executed on call to carry out day-to-day operational requirements. The programmer is freed from defining data structure and these procedures use powerful commands like REPORT rather than ADD and MOVE.

An information system as referred to in this paper is a generalized application and data base software system that is accessed through a user interface using a command language (Figure 4). It can be used in both a

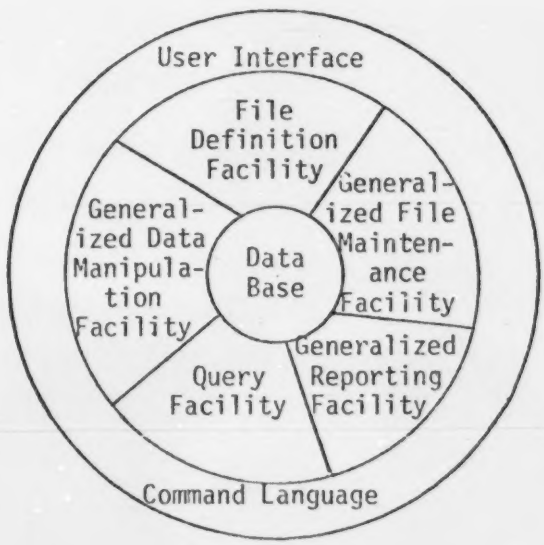

Figure 4 Information System Software

batch and time-sharing environment. It is powerful enough for the programming staff to implement all major applications yet simple enough that users can apply it to their immediate needs.

RATIONALE

The rationale for turning to this type of system is based on the increasing cost of people within a data processing installation, the current state of programmer productivity and on the needs of users to meet their changing information requirements. Figure 5 relates the change in a typical DP budget over the years. Hardware costs have gone down while people costs have risen. Some experts estimate that by 1985 approximately 90% of all the DP budget will be in people or people-related costs.

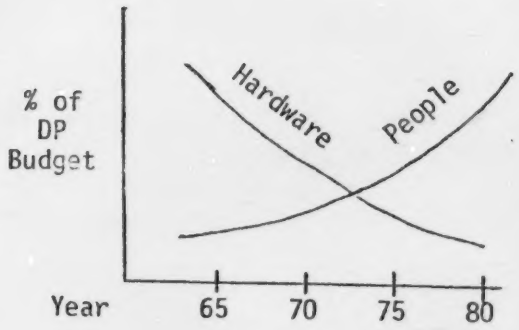

Figure 5

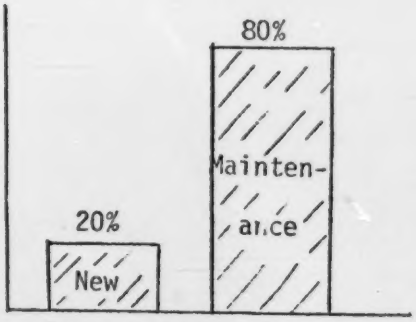

Figure 6

Figure 6 relates the decline of programmer productivity. Due to the overhead of previous systems, the complexity of these systems, new user demands and the rapid state of change, programmers are currently spending a great deal of time debugging and maintaining application code. Some experts estimate that at many installations programmers produce only three to five lines of new code per day and that by 1980 over 80%

of programming time will be spent doing maintenance. Users, encountering the need for more information for decision making, are becoming frustrated by the current state of affairs. An obvious answer to these problems is new programming solutions which would increase the effectiveness of the DP installation for the same money, increase programmer productivity and permit the user to access their own data for ad hoc requirements.

The data processing installation at Citrus College, a public community college with an enrollment of approximately 10,000 students, was faced with all of the problems above except that the budget had not kept pace with the demand. Therefore, staff was cut to meet the budget crunch. There were over 600 different application programs to maintain. Many were still running under 1400 emulation on the IBM 360/40 at the center. There was a need to install new hardware to meet the demands of the instructional program which created an impossible conversion problem. New systems development had almost halted and reaction time to user requests was, at best, poor. It was difficult to adapt the old programs to the changing requirements and it was almost impossible to integrate and combine data from several different applications for reporting.

Faced with this situation a decision was made to develop an information system of the type described. It was hoped that 80% to 85% of all applications could be developed with this system with the remainder implemented using traditional programs. In fact, today 100% of all applications are running on the system with no traditional programs. Some of the major benefits derived from this system include the following:

1. One system which does all file maintenance and reporting thus eliminating the need for application programs.
2. Most requests can be satisfied in a matter of minutes if the data is currently in the files.
3. Most one-time needs are done by the users themselves.

4. New applications can be quickly developed and implemented.
5. System is designed for change.
6. System will link files from different applications for reporting.
7. Eliminated all 1400 emulations in less than one year.
8. Permitted the decision to change from IBM to XEROX hardware. Only the one system was converted; then all user-defined control statements ran on the new hardware.
9. Serves as a super utility for operations.
10. Provided a means and incentive for upgrading the programming staff.

The installation at Citrus College has moved from a second generation batch card shop to an on-line oriented installation. Almost all data entry is done by users and they have immediate access to their data through the information system.

FACILITIES

The information system is a general purpose file maintenance and reporting system. It is control-statement driven which makes its functions easy to use, provides flexibility and allows for change. The system will manage any number of files and allows up to ten of these files to be used simultaneously.

There are two main subsystems within the information system, each having a number of functions. The first of these is the file definition subsystem which is used to describe the data to the system. The second is the file management and reporting subsystem which manipulates the data and provides the reporting functions.

To use the system the user first uses the file definition subsystem to describe the data and the relationships between the data to the system. Relationships between two or more files may also be defined and tables may

be established for data verification, substitution and accumulation.

Once the file is defined the file management and reporting subsystem can be used to load and maintain the files as well as to provide a wide range of reporting capabilities. File definition can be easily altered without affecting the data already in the data base or the procedures already defined. The users may define new relationships when necessary to meet special processing requirements. Each file or user accesses the system through one or more directories. Specifically the file definition subsystem includes the following functions:

1. Definition of certain system default parameters for a specified user directory. Many of these parameters such as page size and line size may be altered by the user at execution time.

2. Creation and maintenance of file directories which define the structure of the data within a file.

3. Creation and maintenance of user directories which define the data available to a user and define relationships between files.

4. Creation and maintenance of tables for data verification, substitution and accumulation. Typically used for data like a chart of accounts, zip codes for cities, full state names and conversion tables like department number to department name.

This subsystem can be accessed from both batch and timesharing and directories may be created and altered dynamically without affecting current users.

The file management and reporting subsystem has a number of generalized functions listed below which permit the user to process the files. It runs from both batch and timesharing and can be operated in a transaction processing mode. Control statements can be entered directly or executed by the user from files.

FUNCTIONS

FILE MAINTENANCE

LOAD	Creates a new file
ADD	Adds records to an existing file
UPDATE	Updates records in an existing file
DUMP	Spins off another file of selected data elements to disk or tape
CLEAR & INITIALIZE	Sets data elements to specified values
CHANGE	A super data correction facility that allows direct data entry into specified fields in selected records
SYSTEM DUMP/RESTORE	Provides full system backup to disk or tape
REORGANIZE	Allows alteration or deletion of primary keys and records from the system

REPORTING

STANDARD REPORTER	Predefined format with page and column headings. Easy to use with a typical report taking 1 to 3 control statements
FREE FORMAT REPORTER	Somewhat like RPG in that it allows the user complete control over the reporting facility
LABEL PRINTER	Gives multiple up records for gummed labels
DISPLAY	Typically used on-line to display selected data from given records based on keys

MISCELLANEOUS

SORT	Sorts data logically into any given order for use by other functions
SELECTION	Allows the user through key-value sets and boolean logic to apply selection criteria to other functions
COMPUTE	Provides for computations, specialized updating requirements and specialized reporting requirements not easily obtained from other functions. This most powerful function in the system also provides terminal definition and control along with journalization for a transaction processing type of environment.

INDEX BUILD	Allows the user to define secondary indexes and relationships dynamically as needed
DATA BASE I/O	Provides automatic file searching and I/O functions for the entire system. May also be driven directly through the COBOL interface or by the COMPUTE function

STRUCTURE UNDER CP-V

The total information system as defined for CP-V currently consists of the seven processes listed below. They will run either in a batch or time sharing environment. The enqueue feature of CP-V is used to provide full file sharing for multiple, simultaneous users. The transaction processing features of CP-V are not used and are not required. A COBOL interface is provided along with a set of subroutines to permit access to the data base through COBOL programs.

PROCESSORS

Processor name	Purpose
FORMATXX	The file definition processor which is used to define files, master directories and tables.
INFRMSYS	The file maintenance and reporting system which contains the data manipulation functions.
INQUIRE	A subset version of INFRMSYS which contains no file updating or maintenance function. Designed to provide SORT, SELECT, DISPLAY and reporting functions to users.
COMMAND	The shared command processor version of the COMPUTE execution function which executes only precompiled COMPUTE procedures. Designed for use by users in a transaction processing environment where prewritten update/inquiry procedures are provided.
ACCOUNTS	Defines account authorization for COMMAND and INQUIRE.
SAVEJRNL	Saves and combines journals created by COMMAND or the COMPUTE function.
DEBLOCK	Searches combined journal files created by SAVEJRNL for selected transactions.

APPLICATIONS

As indicated earlier 100% of all applications at Citrus College run on this system. Most applications run on-line and much of the data entry is done by users from remote terminals. Users have been trained to use the system and do many ad hoc requests themselves. The programming staff of two people spend about 5% of their time doing maintenance with the remainder of their time devoted to the design and implementation of new systems. Some of the applications currently running at Citrus using the system are:

1. Full student services including on-line admissions and registration
2. On-line master schedule building and maintenance
3. On-line personnel
4. Budget and financial
5. Textbook ordering and inventory for campus bookstore
6. Test scoring and analysis using an on-line scanner.

The IBM version of the system is still in use at three data centers serving over a dozen school districts in the Los Angeles area. It is also being used by a local manufacturing company. The XEROX version, while compatible with the IBM version at the command level has been greatly enhanced to take advantage of the features of CP-V. The original version was completed in 1974 and it is now in its fifth significant update.

RECOMMENDATION

It has been shown by the experience at Citrus College that the concept of a generalized information system is viable and that an installation can efficiently operate using such a software package. DP managers must face the realization that the traditional mode of operation is self-defeating and will not meet the changing needs of their users. They must be willing to face the discontinuity of changing from the traditional mode to the

information system orientation. We must get away from one program for each little application and get on with serving our users.

Data processing practitioners must insist that hardware manufacturers and software houses provide powerful state-of-the art application-oriented software packages. These information systems should be easy to use both for programmers and users of DP services. The interfaces should tend toward natural language and away from the typical DP gibberish. On the other side, manufacturers should outfit their hardware with these systems and provide easy methods for conversion through central file management systems.